

REMARKS

The claims have been reviewed and amended in view of the search report, and particularly in view of U.S. Patent 4,836,278 which was considered of particular relevance since Claims 1, 2 and 8-15 were not considered novel or were not considered to involve an inventive step when the document is taken alone.

The '278 Patent is directed to a substantially dissimilar system from the present invention, which is directed to the inner riser adjustable hanger and seal assembly for applying tension to a casing string secured at the lower end within a well and supported at the upper end by a wellhead housing. The '278 Patent is directed to the setting of packers to inject fluid through perforations provided in a tubing string. The '278 Patent is directed to a temporary tool for injecting fluid, and is not directed to a system for permanently applying tension to a casing string.

The claims as amended indicate that the wellhead housing includes the housing locking member, such as one or more grooves, and a seal body locking member for engagement with the housing locking member to fix the axial position of the seal body relative to the wellhead housing. No component can reasonably be considered a seal body as disclosed in the '278 Patent. Assuming the Examiner were to take the position that the tubing string is the seal body, '278 Patent does not disclose securing the tubing string at its upper end to the wellhead housing as recited in the pending claims. Also, the '278 Patent does not disclose an upper seal assembly for sealing between the seal body and the wellhead housing as recited in the present claims.

The '278 Patent does disclose providing a temporary tension to the tubing string to set a packer, and thereafter applying tension to release the packer. The reference does not disclose, however, a tensioning mechanism for tensioning a casing string to secure the upper end of the casing string to the wellhead housing, with the tensioning mechanism including a plurality of axially spaced tension members on an inner surface of a tensioning sleeve fixed to the wellhead housing, with the tensioning mechanism axially connecting in tension the casing string to a selected one or more of the plurality of axially spaced tension members such that a desired tension is exerted on the casing string. Temporarily tensioning a tubing string for the purpose of setting a packer is drastically different than providing a tensioning mechanism to provide a selected and variable tension to the casing string by engaging axially spaced tension members on an inner surface of a tensioning sleeve fixed to the wellhead housing. The cited reference does not teach connecting a casing string in tension to selected axially spaced tension members. Amended Claim 1 recites that the seal body is positioned radially within the tensioning mechanism. Finally, Claim 1 as amended recites that the seal body is fluid permeable from the upper seal assembly to the lower seal assembly, which is not the case for the tubing string in the cited reference.

Independent Claim 13 has been amended to recite the tensioning mechanism as recited in Claim 1, and is also amended to recite that the seal body is radially within the tensioning mechanism. Independent Claim 13 as amended further recites that the wellhead housing has one or more grooves on an inner surface thereof, and recites one

or more teeth radially movable into engagement with the one or more grooves to fix the axial position of the seal body relative to the wellhead housing.

Independent method Claim 14 has also been amended to recite in greater detail the tensioning mechanism set forth in amended Claim 1, and recites that the seal body is positioned radially within the tensioning mechanism.

Newly added Claim 20 depends upon Claim 1, and recites that the seal body lands on the wellhead housing before the seal body locking member moves into engagement with the housing locking member. Dependent Claim 21 depends upon Claim 13 and includes a similar limitation. Dependent Claims 22-28 each depend upon Claim 13, and are directed to features set forth in claims dependent upon Claim 1. Newly added Claim 29 recites that the seal body is fluid impermeable from the upper seal assembly to the lower seal assembly.

A clean copy of the amended claims appear on replacement pages 15-20.

In view of the above, early allowance of the Application is requested.

Respectfully submitted,


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CERTIFICATE OF FACSIMILE AND FIRST-CLASS MAIL

I hereby certify that this correspondence and all referenced enclosures are being faxed to (41-22) 740.14.35 and deposited by me with the United States Postal Service, postage prepaid as First-Class Mail in an envelope addressed to International Bureau of WIPO, 34, chemin des Colombettes, 1211 Geneva 20 Switzerland on this the 22 day of July 2004.

By:


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Clean Copy of Claims

1. An inner riser adjustable hanger and seal assembly for applying tension to a casing string secured at a lower end at a well and supported at an upper end by a wellhead housing, the hanger and seal assembly comprising:

the wellhead housing having a housing locking member on an inner surface thereof;

a tensioning mechanism for tensioning the casing string and securing the upper end of the tensioned casing string to the wellhead housing, the tensioning mechanism including a plurality of axially spaced tension members on an inner surface of a tensioning sleeve fixed to the wellhead housing, the tensioning mechanism axially connecting in tension the casing string to a selected one or more of the plurality of axially spaced tension locking members until the desired tension is exerted on the casing string;

a seal body for positioning within the wellhead housing and radially within the tensioning mechanism;

a seal body locking member radially movable into engagement with the housing locking member to fix the axial position of the seal body relative to the wellhead housing;

an upper seal assembly for sealing between the seal body and the wellhead housing; and

a lower seal assembly for sealing between the seal body and the casing string, such that the casing string is tensioned without appreciable rotation of the hanger body,

and the seal body being fluid impermeable from the upper seal assembly to the lower seal assembly.

2. An inner riser adjustable hanger and seal assembly as defined in Claim 1, wherein the casing string is tensioned without appreciable rotation of the upper and lower seal assemblies.

3. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

at least one of an outer surface of the upper end of the casing string and an inner surface of the seal body is tapered; and

a setting sleeve moves axially relative to the seal body to move the lower seal assembly into sealing engagement with both the seal body and the upper end of the casing string.

4. An inner riser adjustable hanger and seal assembly as defined in Claim 3, further comprising:

at least one shear member for interconnecting the setting sleeve and the seal body; and

a detent ring radially movable to allow shearing of the shear member to set the lower seal assembly.

5. An inner riser adjustable hanger and seal assembly as defined in Claim 4, further comprising:

a plurality of circumferentially spaced buttons for moving the detent ring radially inward.

6. An inner riser adjustable hanger and seal assembly as defined in Claim 3, further comprising:

a radial collapsible detent ring; and

one or more shear pins for interconnecting the setting sleeve and the seal body, such that an axial force is transmitted to shear the shear pins to move the detent ring radially inward.

7. An inner riser adjustable hanger and seal assembly as defined in Claim 4, further comprising:

a plurality of radially moveable buttons or moving the detent ring into a collapsed position prior to shearing the shear pins.

8. An inner riser adjustable hanger and seal assembly as defined in Claim 1, wherein the seal body locking member is a C-ring.

9. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

a support ring, at least a portion of which is positionable radially inward from and axially moveable relative to the seal body locking member for maintaining the seal body locking member in engagement with the housing locking member.

10. An inner riser adjustable hanger and seal assembly as defined in Claim 8, wherein the C-ring is carried on the seal body and is biased radially outward.

11. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

a centralizing ring positioned at a lower end of the seal body for centralizing the lower end of the seal body relative to the upper end of the casing string.

12. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

at least one of an outer surface on the seal body and an inner surface on the wellhead housing is tapered; and

the upper seal assembly moves axially relative to the wellhead housing from a run-in position to a set position to seal between the seal body and the wellhead housing.

13. An inner riser adjustable hanger and seal assembly for applying tension to a casing string secured at a lower end at a well and supported at an upper end by a

wellhead housing, the hanger and seal assembly comprising:

the wellhead housing having one or more grooves on an inner surface thereof;

a tensioning mechanism for tensioning the casing string and securing the upper end of the tensioned casing string to the wellhead housing the tensioning mechanism including a plurality of axially spaced tension members on an inner surface of a tensioning sleeve fixed to the wellhead housing, the tensioning mechanism axially connecting in tension the casing string to a selected one or more of the plurality of axially spaced tension locking members until the desired tension is exerted on the casing string;

a seal body for positioning within the wellhead housing and radially within the tensioning mechanism;

one or more teeth radially movable into engagement with the one or more grooves to fix the axial position of the seal body relative to the wellhead housing;

an upper seal assembly for sealing between the seal body and the wellhead housing; and

a lower seal assembly for sealing between the seal body and the casing string, such that the casing string is tensioned without appreciable rotation of the seal body, the upper seal assembly, or the lower seal assembly.

14. A method of applying tension to a casing string secured at a lower end at a well and supported at an upper end by a wellhead housing, the method comprising:

providing the wellhead housing having a housing locking member on an inner surface thereof;

providing a tensioning mechanism for tensioning the casing string, the tensioning mechanism including a plurality of axially spaced tension members on an inner surface of a tensioning sleeve fixed to the wellhead housing, the tensioning mechanism axially connecting in tension the casing string to a selected one or more of the plurality of axially spaced tension locking members until the desired tension is exerted on the casing string;

securing the upper end of the casing string to the wellhead housing;

positioning a seal body within the wellhead housing and radially within the tensioning mechanism;

providing a seal body locking member;

radially moving the seal body locking member into engagement with the housing locking member to fix the axial position of the seal body relative to the wellhead housing;

positioning an upper seal assembly between the seal body and the wellhead housing, for sealing therebetween; and

positioning a lower seal assembly between the seal body and the casing string, such that the casing string is tensioned without appreciable rotation of the hanger body.

15. A method as defined in Claim 14, further comprising:

tensioning the casing string without appreciable rotation of the upper or lower

seal assemblies.

16. A method as defined in Claim 14, further comprising:
providing at least one of a tapered outer surface of the upper end of the casing string and a tapered inner surface of the seal body;
providing a setting sleeve axially movable relative to the seal body; and
axially moving the setting sleeve relative to the seal body to move the lower seal assembly into sealing engagement with both the seal body and the upper end of the casing string.

17. A method as defined in Claim 14, further comprising:
providing at least one shear member;
providing at least one detent ring;
interconnecting the setting sleeve and the seal body with the shear member; and
selectively radially moving the detent ring to allow shearing of the shear member to set the lower seal assembly.

18. A method as defined in Claim 14, further comprising:
providing a support ring;
positioning at least a portion of the support ring radially inward from the seal body locking member; and

axially moving the support ring relative to the seal body locking member to maintain the seal body locking member in engagement with the housing locking member.

19. A method as defined in Claim 14, further comprising:

providing a centralizing ring;

positioning the centralizing ring at a lower end of the seal body for centralizing the lower end of the seal body relative to the upper end of the casing string.

20. An inner riser adjustable hanger and seal assembly as defined in Claim 1, wherein the seal body lands on the wellhead housing before the seal body locking member moves into engagement with the housing locking member.

21. An inner riser adjustable hanger and seal assembly as defined in Claim 13, wherein the seal body lands on the wellhead housing before the seal body locking member moves into engagement with the housing locking member.

22. An inner riser adjustable hanger and seal assembly as defined in Claim 13, further comprising:

at least one of an outer surface of the upper end of the casing string and an inner surface of the seal body is tapered; and

a setting sleeve moves axially relative to the seal body to move the lower seal –

assembly into sealing engagement with both the seal body and the upper end of the casing string.

23. An inner riser adjustable hanger and seal assembly as defined in Claim 22, further comprising:

at least one shear member for interconnecting the setting sleeve and the seal body; and

a detent ring radially movable to allow shearing of the shear member to set the lower seal assembly.

24. An inner riser adjustable hanger and seal assembly as defined in Claim 22, further comprising:

a radial collapsible detent ring; and

one or more shear pins for interconnecting the setting sleeve and the seal body, such that an axial force is transmitted to shear the shear pins to move the detent ring

25. An inner riser adjustable hanger and seal assembly as defined in Claim 13, wherein the seal body locking member is a C-ring.

26. An inner riser adjustable hanger and seal assembly as defined in Claim 13, further comprising:

a support ring, at least a portion of which is positionable radially inward from and axially moveable relative to the seal body locking member for maintaining the seal body locking member in engagement with the housing locking member.

27. An inner riser adjustable hanger and seal assembly as defined in Claim 13, further comprising:

a centralizing ring positioned at a lower end of the seal body for centralizing the lower end of the seal body relative to the upper end of the casing string.

28. An inner riser adjustable hanger and seal assembly as defined in Claim 13, further comprising:

at least one of an outer surface on the seal body and an inner surface on the wellhead housing is tapered; and

the upper seal assembly moves axially relative to the wellhead housing from a run-in position to a set position to seal between the seal body and the wellhead housing.

29. An inner riser adjustable hanger and seal assembly as defined in Claim 13, wherein the seal body is fluid impermeable from the upper seal assembly to the lower seal assembly.